

Abstract for AMOS Technical Conference, 13-16 Sept 2011
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A Search for Optically Faint GEO Debris^{1,2}

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Existing optical surveys for debris at geosynchronous orbit (GEO) have been conducted with meter class telescopes, which have detection limits in the range of 18th-19th magnitude. We report on a new search for optically faint debris at GEO using the 6.5-m Magellan 1 telescope ‘Walter Baade’ at Las Campanas Observatory in Chile. Our goal is to go as faint as possible and characterize the brightness distribution of debris fainter than R = 20th magnitude, corresponding to a size smaller than 10 cm assuming an albedo of 0.175. We wish to compare the inferred size distribution for GEO debris with that for LEO debris.

We describe results obtained during 9.4 hours of observing time during 25-27 March 2011. We used the IMACS f/2 instrument, which has a mosaic of 8 CCDs, and a field of view of 30 arc-minutes in diameter. This is the widest field of view of any instrument on either Magellan telescope. All observations were obtained through a Sloan r' filter. The limiting magnitude for 5 second exposures is estimated to be fainter than 22.

With this small field of view and the limited observing time, our objective was to search for optically faint objects from the Titan 3C Transtage (1968-081) fragmentation in 1992. Eight debris pieces and the parent rocket body are in the Space Surveillance Network

public catalog. We successfully tracked two cataloged pieces of Titan debris (SSN # 25001 and 33519) with the 6.5-m telescope, followed by a survey for objects on similar orbits but with a spread in mean anomaly.

To detect bright objects over a wider field of view (1.6x1.6 degrees), we observed the same field centers at the same time through a similar filter with the 0.6-m MODEST (Michigan Orbital DEbris Survey Telescope), located 100 km to the south of Magellan at Cerro Tololo Inter-American Observatory, Chile.

We will describe our experiences using Magellan, a telescope never used previously for orbital debris research, and our initial results.

1. This work is supported by NASA's Orbital Debris Program Office, Johnson Space Center, Houston, Texas, USA.
2. This paper includes data gathered with the 6.5 meter Magellan Telescopes located at Las Campanas Observatory, Chile.